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ABSTRACT

The Machine Tool Advanced Skills Technology Program (MAST) is a geographical partnership of six of the nation's best two-year colleges located in the six states that have about one-third of the density of metals-related industries in the United States. The purpose of the MAST grant is to develop and implement a national training model to overcome skill shortages in the machine tool industry and metals-related industries for certificate and Associate of Applied Science degree options. MAST is intended to address these issues: increase awareness and identify career opportunities; develop school-to-work programs; upgrade skills of out-of-school unemployed and existing industry employees; and establish curricula standards with industry validated competencies and apprenticeship/internships centers, test centers, manufacturing technology centers, federal labs supporting metal and machinery, and companies. The MAST methodology includes the following: (1) identification of machinist competency profile duties and tasks; (2) preparation of a "Technical Workplace Competency/Crosswalk" identifying each required course; (3) development of an "Exit Level Proficiency Matrix" for the technical workplace competencies; and (4) identification of expected competencies and foundation skills expected of potential employers that were identified by the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). A national survey is planned after specific company skills standards have been completed. (YLB)

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Machine Tool Advanced Skills Technology Program (MAST)

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Machine Tool Advanced Skills Technology Program

MAST

OVERVIEW AND METHODOLOGY

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What is MAST?

The Machine Tool Advanced Skills Technology Program (MAST) is a geographical partnership of six of the nation's best two-year colleges located in the six states that have about one-third of the density of metals-related industries in the United States.

Texas State Technical College at Waco, along with five other Advanced Technology Centers in five other states, were awarded a \$1.472 million U.S. Department of Education grant in the Fall of 1994 to develop skills standards for metal and metal-related occupational specialties in accordance with the National Skills Standards Act of 1994.

The Goals of the National Skills Standards Act of 1994, as paraphrased, are:

- (1) *Determine significant occupational clusters;*
- (2) *Develop a common nomenclature relating to skill standards;*
- (3) *Encourage the development and adoption of curriculum and training materials for attaining the skill standards;*
- (4) *Provide structural work experiences and related study programs leading to progressive levels of professional and technical certification and post-secondary education;*
- (5) *Review voluntary skill standards projects, to include those standards used in other countries and related international standards and review methods of assessment and certification used in other countries;*
- (6) *Provide for regular updating of technical skills through continuing education course offerings;*
- (7) *Promote portability of credentials and facilitate worker mobility;*
- (8) *Utilize a variety of educational techniques including oral, written, portfolio and performance based testing;*
- (9) *Perform assessments consistent with Federal Civil Rights Laws;*
- (10) *Promote dissemination of Skills Standards;*
- (11) *Establish standards for skills needed by current and new employees;*
- (12) *Consult with experts and practitioners to determine the duties, tasks, skills and proficiencies required by industry;*
- (13) *Validate skill standards through extensive industry review;*
- (14) *Develop an appropriate assessment/documentation and certification system;*
- (15) *and disseminate the skill standards throughout the education communities and industry.*

What is the purpose of MAST?

The purpose of the MAST grant is to develop and implement a national training model to overcome skill shortages in the machine tool industry and metals related industries for certificate and Associate of Applied Science degree options.

Why is there a need for MAST?

Skill shortages severely limit the U.S. productivity within the American machine tool industry. We must train multi- skilled technicians capable of installing, integrating, maintaining, diagnosing, repairing and modifying technologically advanced equipment systems. The survival of existing U.S. industries depends upon the integration of advanced technologies, innovative training programs and methodologies, and new curricula to remain competitive in a world market.

PROBLEMS CONFRONTING INDUSTRY:

- Lack of clearly defined standards for the machine tool industry.
- Low academic skill levels of existing employees.
- Lack of employability skills by many applicants.
- Lack of qualified applicants for training and apprenticeships.
- Availability of work-based training.
- Productivity issues (equipment operations limited by worker skills)
- Need for flexible training approaches for special populations and adult learners.

The National Center for Manufacturing Sciences (NCMS) identified that of the top twenty manufacturing states, Texas experienced the largest increase in manufacturing employment. Manufacturing will add over 70,000 additional jobs in Texas by the year 2000 with increases in both durable and non-durable goods.

In Texas, projected increases by the year 2000 include 4,050 jobs for machine mechanics (24% growth rate); 4,700 jobs for machinists (18% growth rate); 3,850 numeric control operators (20% growth rate); and 107,150 general maintenance repair technicians (23% growth rate).

What are the issues to be addressed by MAST?

1. Increase awareness and identify career opportunities in the machine tool and metal related industries for secondary school students.
2. Develop school-to-work programs for secondary school students with planned training and industrial apprenticeships.
3. Offer out-of-school unemployed and existing industry employees the opportunities to learn new skills (skills upgrading).
4. Establish curricula standards with industry validated competencies and apprenticeship/internships with industrial partners (workplace training experiences as capstones of curricula).

What are the goals of MAST?

1. Industrial Assessment:
Perform a comprehensive, industry-wide assessment of entry level skills and competencies to determine current and future training needs of the industry enhancing productivity and global competitiveness.
2. Curriculum Development:
Design and develop a comprehensive series of core and specialized courses with laboratory "hands-on" training specific to the needs of the industry and current with emerging technologies in the machine tool and metals related industries. The curriculum must incorporate the emerging technology applications and provide the competency based training required of industry for today and the future.
3. Pilot Program Development:
Conduct a one year pilot program with 25 or more selected applicants at each college curriculum development center to evaluate curriculum content and effectiveness.
4. Student Assessment:
Identify skills competencies of program applicants at point of entrance and point of exit for entry level and already employed technicians.
5. Project Deliverables:
Compile and package the program model in multi-media form for national dissemination. The model will include course syllabi, required texts and handbooks, recommended lab equipment, and examinations to evaluate specific industrial skills standards.

Who are the MAST Partners? (See map on next page)

Geographic partnership of six of the nation's best community and technical colleges, located in six states housing one-third of the density of metals related industries in the United States.

Design and Development Centers:

Texas State Technical College, Waco, Texas
Augusta Technical Institute, Georgia
Itawamba Community College, Mississippi
Moraine Valley Community College, Illinois
San Diego City College, California
Springfield Technical Community College, Massachusetts

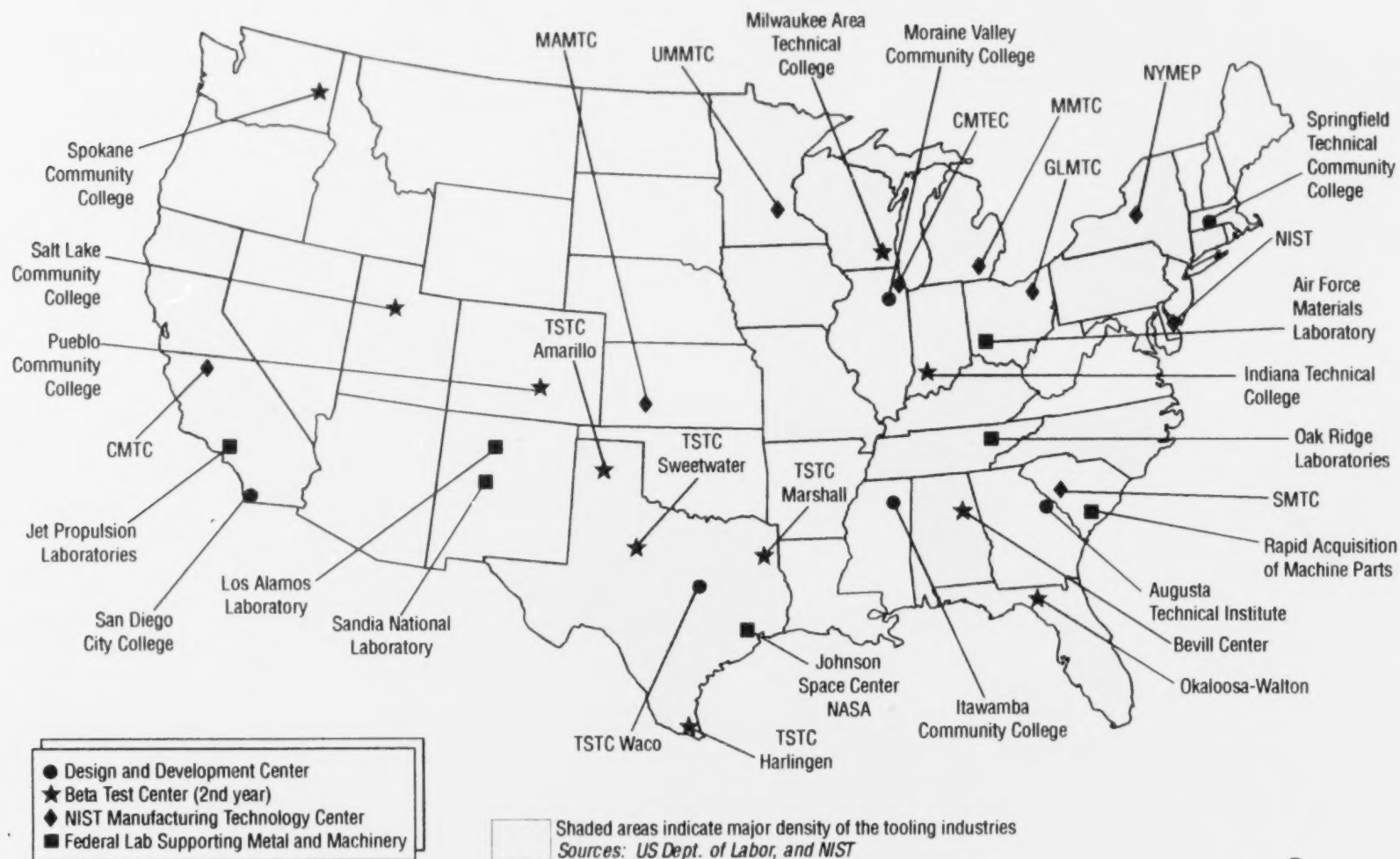
Test Centers:

Spokane Community College, Washington
Salt Lake Community College, Utah
TSTC, Sweetwater, Texas
TSTC Marshall, Texas
TSTC Amarillo, Texas
TSTC Harlingen, Texas
Okaloosa-Walton, Florida
Bevill Center, Alabama
Indiana Technical Institute, Indiana
Milwaukee Area Technical College, Wisconsin

NIST Manufacturing Technology Centers:

California
Kansas
Minnesota
Illinois
Michigan
New York
Ohio
New Jersey
South Carolina

MACHINE TOOL ADVANCED SKILLS TECHNOLOGY PROGRAM (MAST)



Federal Labs Supporting Metal and Machinery:

Jet Propulsion Labs, California
Los Alamos Laboratory, New Mexico
Sandia National Laboratory, New Mexico
Johnson Space Center, Texas
Oak Ridge National Laboratories, Tennessee
Rapid Acquisition of Machine Parts, South Carolina
Air Force Materials Laboratory, Ohio

Companies which are participating as MAST Partners:

Bell Helicopter
Chrysler Technologies Airborne Systems
Eaton Leonard
Lockheed Martin
NASSCO
Southwest Fabricators
Darr Equipment
Mercury Tool & Machine
DJ Plastics
ROHR
Laser Fare, Inc.
EBTEC Corporation
Smith & Wesson
Tecumseh Products
Greco Systems
FMC Corporation
Fulghum Industries
Donson Machine
G&W Electric Company
TEXCEL Corporation
Taylor Guitars

Bowen Tool
Davis Technologies
GeoDiamond
McDonnell Douglas
Solar Turbines
Reed Tool
ALCOA
Eureka
Foster Mold
Laser Services, Inc.
AB Laser
American Saw & Mfg. Co.
Time Manufacturing
MOOG Automotive
Teledyne Ryan Aeronautical
Greenfield Industries
Andrew Corporation
Alsip Machining Group
Alden Corporation
Hamilton Standard

What are the Machine Tool Speciality Areas which MAST will investigate?

EDM/Suprabraves Technicians
Manufacturing Engineering Technicians
Aircraft Sheet Metal Repair Technicians
Computer Integrated Manufacturing Technicians
Industrial Machine Mechanics
CAD/CAM Technicians

Shop Floor Control Specialists
Instrumentation Technicians
Computer Networking Specialists
Laser Electro-Optics Technicians
NC/CNC/DNC Programmers
Welding/ Metallurgy Technicians

How will MAST accomplish their task?

As lead institution, TSTC at Waco has developed a methodology that is widely recognized as a desirable model by the U.S. Departments of Education and Labor, organized labor, and many industries that have participated in this study. A short description follows:

COMPETENCY PROFILE METHODOLOGY

The Machinist Competency Profile Duties and Tasks have been identified by practitioners in the machining trade and are therefore "industry driven." A modified DACUM was performed at industry sites and facilitated by TSTC representatives of the Economic Development and Industrial Training Center. Panel Members are identified on the Competency Profile. Panel members were requested to identify job entry level skills and competencies, rank each Duty and Task, and identify the expected "sub-tasks" required to perform each Task within a given Duty. A complete list of industry generated Duties and Tasks has been prepared for each occupational specialty and entitled "Technical Workplace Competencies". Additional skills for Mathematics, Science, and General Education courses were also identified by the panel members. The panel generated a list of "Skills and Knowledge", "Traits and Attitudes", and "Future Trends and Concerns" and are listed on the Competency Profiles. TSTC MAST Project personnel prepared the initial draft Competency Profiles and Technical Workplace Competencies for review and comment by panel members. Once final "industry validated" copy was secured, MAST Project personnel prepared extended course syllabi reflecting the industry's expectations of technical competencies, SCANS skills, and expected exit level proficiencies for each specific occupational specialty.

COMPETENCY COURSE CROSSWALK: METHODOLOGY

Once the Technical Competencies were identified a "Technical Workplace Competency/Crosswalk" was prepared identifying each required course in the Manufacturing Engineering Technology Machinist Certificate program at TSTC and the specific Tasks and taught in each respective course. An "Exit Proficiency Level Matrix" was developed for the Technical Workplace Competencies and each task was assigned an expected proficiency level at minimum performance level expectations of industry. The preparation of the "Technical Workplace Competency/Crosswalk allowed faculty to review, modify, and adjust course syllabi to meet the expected exit level proficiencies and identify specific student activities within required courses that permit evaluation of each proficiency level.

SCANS/COURSE CROSSWALK: METHODOLOGY

Panel members identified expected SCANS Competencies and Foundation Skills expected of potential employers. This information is presented in a "SCANS/Course Crosswalk" for the Machinist Certificate option. All required courses in the Manufacturing Engineering Technology Machinist Certificate program were "crosswalked" against the SCANS Competencies and the SCANS Foundation Skills. Exit Level Proficiencies were identified for the SCANS Competencies and the SCANS Foundation Skills against an "Exit Level Proficiency Matrix". In order to "close the loop", all specific SCANS activities that are to be demonstrated by students were identified in the course syllabi for the Machinist Certificate option. SCANS Competencies and specific classroom activities to address each SCANS Competency have been identified for the General Education courses and are included in the methodology.

Industry on-site visits involved a tour of facilities, review of pertinent job descriptions, and a modified DACUM process resulting in a Competency Profile for each occupational speciality. Employers and employees described expectations of worker skills, identified current required skills, and projected future trends. Employers in respective occupational specialties voiced their expectations for training of future employees. A description of duties and specific tasks for each occupational speciality were prepared, prioritized, and validated by the Company Team. The project officials act primarily as facilitators in the process responsible for documenting the comments and preparing the occupational skills profiles. Employers also stated their expectations of any training programs and apprenticeships that could lead to employment within their company. Expectations for prerequisites and knowledge of math, sciences, and general education were also expressed for each occupational speciality. A list of structured questions were presented to each group, and sessions were tape-recorded for later transcription and review.

The facilitators then returned to the project officer, cataloged the conclusions and findings on a diskette, prepared a graphical representation of findings, and transmitted these to the partnership company. The company would review and edit these documents, return them to the MAST institution who would then input the data on "PageMaker", "First Task", and "Course Developer" applications software. A Competency Profile was prepared for the participating company with their company logo and names of panel members.

Once specific company skills standards have been completed with all named partners in each region, a national survey will be mailed to other companies, targeted to respondents who are identified, prepared, and willing to participate in this national survey. From this process a industry validated composite skills standard document will be developed. A final review will be held with invited and interested participants hosted by a nation-wide advisory committee. This will be scheduled as a final and open forum on the specific occupational skills profiles.

Skills standards will also be reviewed by organized labor groups, state agencies, professional societies, and other interested national groups.

Skills standards for each occupational speciality will be field tested for feasibility of training and delivery to educational institutions and trade groups, and finally printed in graphical format for dissemination to companies, educational institutions and other training providers.

Public schools are participants in the process from the beginning, serving on steering committees, providing development experiences for the faculty and counselors, and expanding the vision of young people to provide knowledge of career opportunities in these occupational specialities. Tours of specific industries will be scheduled and in-service training will be scheduled by the sponsoring post-secondary partners for secondary educators.

The second phase (1995-96) of the project will include curricula revisions by institutions and training providers and field testing of the revised curricula with students recruited as experimental groups. Students will be assessed for knowledge gained and mastery of competencies from these enhanced educational experiences and eventual success ratings in employment industries. Apprenticeship experiences will also be defined and enhanced as part of the process. It is known that internships and apprenticeships currently lack definition and documentation of value-added experiences.

Where can you learn more about MAST?

MAST has also begun dissemination of its work on the internet. Be advised that this work is currently under construction and may not include final versions of all project deliverables at this time.

To access this material simply type...

<http://machinetool.tstc.edu>

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